Water Quality Status Report No. 118

Ground Water Study of the Lower Boise River Valley Ada and Canyon Counties, Idaho

Idaho Department of
Health and Welfare
Division of Environmental Quality
May 1996

The field sheet was filled out to note all necessary information of the sampling procedure at every site, any comments relevant to the site and a chain of custody sheet was filled out for the VOC samples. A copy of the field sheet and chain of custody sheet can be found on page 20 and 22, respectively. All equipment used at each site was triple rinsed with deionized water then carefully packed to be re-used at the next site.

At the regional USGS Laboratory in Boise, Idaho all samples, except the 500 ml and 125 ml polyethylene bottle and the unpreserved VOC sample, were placed in the sample refrigerator until they were packed on ice and shipped to the USGS Laboratory in Arvada, Colorado. The sample in the 500 ml polyethylene bottle was used to run the HACH NO2/NO3 at the USGS Laboratory. The sample collected in the 125 ml polyethylene bottle was used to plate for total bacteria and fecal bacteria. The unpreserved VOC bottle was analyzed with a Photovac 10-S Portable Gas Chromatograph to determine presence or absence of VOCs. If VOCs were present, the duplicates are shipped to Alpha Analytical Laboratory in Sparks, Nevada.

Frequency

Sampling started in July 1995 and continued until the end of October 1995. 335 domestic and irrigation wells were sampled one time for this project.

RESULTS

Well Depths

Well depths were grouped into three ranges for this project. Wells that were less than 150 feet below ground surface are considered shallow. Wells greater than 150 feet and less than 250 feet below ground surface are considered intermediate. Wells greater than 250 feet below ground surface are considered regional. These ranges are an arbitrary choice and not dependent on geology. See the geology section of this report for more information on the geology. The breakdown of the depths of the wells sampled are listed in Table 1 on page 23.

Figure 8. Field Sheets

U.S. GEOLOGICAL SURVEY, WRD, GROUND WATER QUALITY FIELD NOTES

Project :Lower Boise River Valley – 4716-18400 Owner _____

Loc. Well No. _____ Address _____

Site I.D. _____ Sampled by– LINDA BOYLE, IdH&W,DEQ (SWIRO)_

Date _____ 1995 Time Pumped before sampling _____ (minutes)

Time _____ Record Number QWDATA _____

FIELD MEASUREMENTS

Temp. Water (00010)	_____ °C	E. Coli (31648)	_____ col./100 mL
Temp. Air (00020)	_____ °C	FS (31673)	_____ col./100 mL
pH (00400)	_____ units	FC (31625)	_____ col./100 mL
Sp. Cond. (00095)	_____ µS/cm25°C	TC (31501)	_____ col./100 mL
Dis. Oxy. (00300)	_____ mg/L	Other	_____
Bar. Press. (00025)	_____ mm Hg	Other	_____
Alkalinity (00410)	_____ mg/L		
Bicarbonate (00440)	_____ mg/L	HACH NITRATE =	_____
Carbonate (00445)	_____ mg/L	Standard =	_____

pH

pH Buffer	PH Buffer Temp °C	Auto Adjusted Reading
___-___		
___-___		
___-___		

Serial No. _____ METER Make/Model *Orion/230A*

electrode type _____

Orion 250A: calibration slope _____

(Auto temp. compensating)
(Measurement in bucket)

FIELD pH = _____

SPECIFIC CONDUCTANCE

standard value	Temp Std °C	Initial Reading	Probe Adj.	Final Meas.

Serial no. _____

METER Make/Model *Orion/122*

(Auto temp. compensating)
(Measurement in bucket)

FIELD CONDUCTANCE = _____

DISSOLVED OXYGEN

Serial no. _____ METER Make/Model *Orion/810*

Orion 820: calibration slope _____

____ Air calibration Chamber in Air

H2O Temp. _____ °C

Bar. Press _____ mm Hg (mm = In. X 25.4)

GROUND WATER D.O. = _____

REMARKS

Sample Point: _____

Color - Odor? _____

Other: _____

GROUND WATER STABILIZATION MONITORING TABLE

Time	T °C	pH	Sp. Cond.	D.O.	Comments
H20 on:					

ALKALINITY

Volume titrated	Sample Temp. °C	pH

Acid 1.6N. 0.1600N. 0.01629N. Other ____

Acid Lot No. _____

Sample Volume _____ mL

Sample stirred:

_____ magnetically _____ manually

Fixed endpoint

Date _____ Time _____

A = DC or mLs acid from initial pH to endpoint near 8.3 _____

B = DC or mLs acid from initial pH to endpoint near 4.5 _____

CALCULATION:

$$CO_3 = A \times \frac{F_1}{ml\ sample} \times CF = \_\_\_\_\_ (00445)$$

$$HCO_3^- = [B - 2(A)] \times \frac{F_2}{ml\ sample} \times CF = \_\_\_\_\_ (00440)$$

$$ALKALINITY\ as\ CaCO_3 = B \times \frac{F_3}{ml\ sample} \times CF = \_\_\_\_\_ (00410)$$

FACTORS	DIGITAL COUNT TITRATION (DC)	
	Using 0.1600 normal	Using 1.60 normal
F1	12.0	120
F2	12.2	122
F3	10.0	100

TOTAL COLIFORM (31501)

Time collected: _____

Time In @ 35 °C _____ Date: _____

Time in @ 44.5 °C _____

Time out: Date:

Vol (ml)	Count	cal?	Remarks*
Blank			
Blank			

*Remarks 1=Less than 2=Greater than 0=Est. ct. K=non ideal ct.

Incub. Time 2 hrs. @ 35 °C followed by:

filt. size _____ 20-24 hrs @ 44.5°C

Ideal count 20-80 col.

E. COLI COUNT /100 mL _____

Note: col. count = (count x 100) ÷ mL sample

FECAL STREPTOCOCCI (31673)

Time collected: _____

Time In: _____ Date: _____

Time out: Date:

Vol (ml)	Count	cal?	Remarks*
Blank			
Blank			

*Remarks 1=Less than 2=Greater than 0=Est. ct. K=non ideal ct.

Incub. Time 46-50 hrs filt. size _____

Ideal count 20-100 col. Incub. Temp 35 °C

FS COUNT /100 mL _____

Note: col. count = (count x 100) ÷ mL sample

FECAL COLIFORM (31625)

Time collected: _____

Time In: _____ Date: _____

Time out: Date:

Vol (ml)	Count	cal?	Remarks*
Blank			
Blank			

*Remarks 1=Less than 2=Greater than 0=Est. ct. K=non ideal ct.

Incub. Time 22-26 hrs filt. size _____

Ideal count 20-60 col. Incub. Temp 44.5 °C

FC COUNT /100 mL _____

Note: col. count = (count x 100) ÷ mL sample

Figure 9. Chain of Custody

U.S. Geological Survey
230 Collins Road
Boise, Idaho 83702

Page_____of_____pages.

CHAIN OF CUSTODY RECORD

Project Number: 4716-18400 LOWER BOISE RIVER VALLEY STUDIES--1995-1996
Samplers: (Signatures)

Site I.D. Number	Location/Well Number	Date	Time	Type	# of bottles	Remarks

Relinquished by: (Signature) _____ Date _____ Time _____ Received by: (Signature) _____
Relinquished by: (Signature) _____ Date _____ Time _____ Received by: (Signature) _____
Relinquished by: (Signature) _____ Date _____ Time _____
Received for Laboratory by:

Table 1. Number of Wells Sampled by Well Depth			
Well Depth	Number of Wells	Domestic Use	Irrigation Use
Shallow - < 150 feet	223	182	41
Intermediate – 150-250 feet	82	78	3
Regional - > 250 feet	30	25	5

Field Parameters

At every site, meters were used to measure temperature, specific conductance, pH, and dissolved oxygen. Alkalinity was calculated at every site by an acid titration method. A list of the field parameter ranges found in the study area can be found in the following table.

Table 2. Selected Water Quality Statistics					
Field Parameters	Number of Samples	Median	Mean	Range	
				Minimum	Maximum
Temperature (°C)	342	14	14.28	11.5	24.5
Specific Conductance (uS/cm at 25°C)	342	487	478	104	1050
pH (standard units)	342	7.3	7.2	5.6	8.8
Alkalinity (mg/l as CaCO3)	342	193	187	35	427
Dissolved Oxygen (mg/l, >7 considered saturated)	225	5.3	4.8	0	>7

Nitrate

Agriculture is the major land use in the study area. There is the potential for nitrate to impact ground water from agricultural practices such as confined animal feeding operations and fertilizers. Septic tanks, decaying organic matter, and storm water have the potential to elevate the nitrate concentration in the ground water.

There was a low percentage of wells (3%) with nitrate results greater than 10 mg/l; the drinking water regulatory level (U.S. EPA 1995). All of these samples were collected from shallow wells. Ten wells were sampled and found to have nitrates greater than the MCL of 10 mg/l. Six of these wells had other constituents of concern in their results. Three wells were impacted by VOCs and/or pesticides in addition to the elevated nitrates. Three wells had total coliform in addition to the elevates nitrates.

Table 3 displays the number of wells with the range of nitrate results by the depth of the well. See the figure on page 25 for the location of the wells listed in Table 2.

Table 3. Nitrate Ranges by Well Depth

A total of 335 nitrate samples collected

Well Depth	Ranges of Nitrate Levels			
	<2 mg/l	>2 - <5 mg/l	>5-<10 mg/l	>10 mg/l
<150′	86	89	38	10
150′-250′	41	35	6	0
>250′	21	9	0	0

Volatile Organic Compounds (VOCs)

There were 7% of the wells sampled with positive results for VOCs in the study area. See the figure on page 26 for location of wells impacted by VOCs.

Tetrachloroethylene was still the most common VOC constituent found

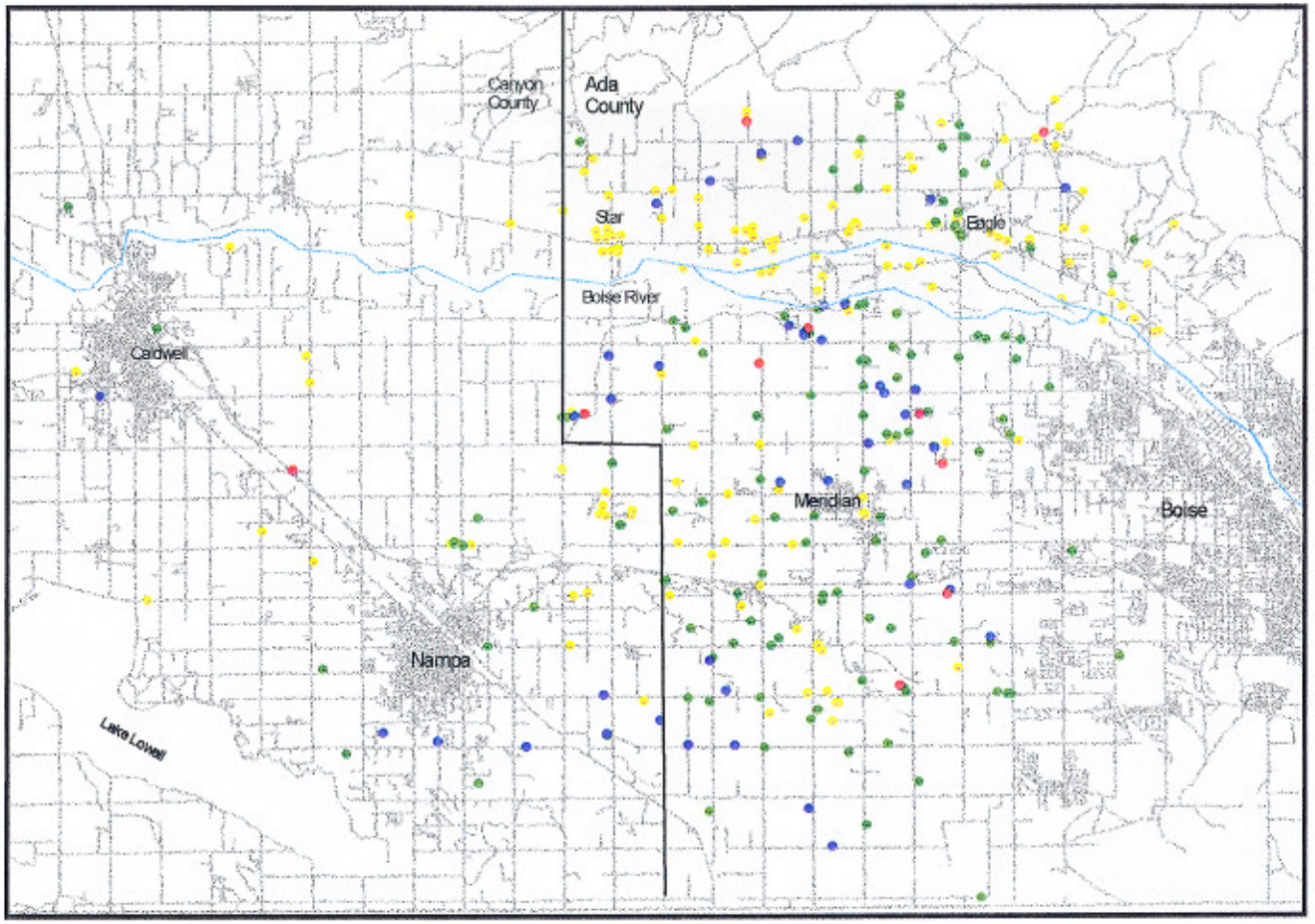


Figure 10. Ranges of Nitrates in Wells

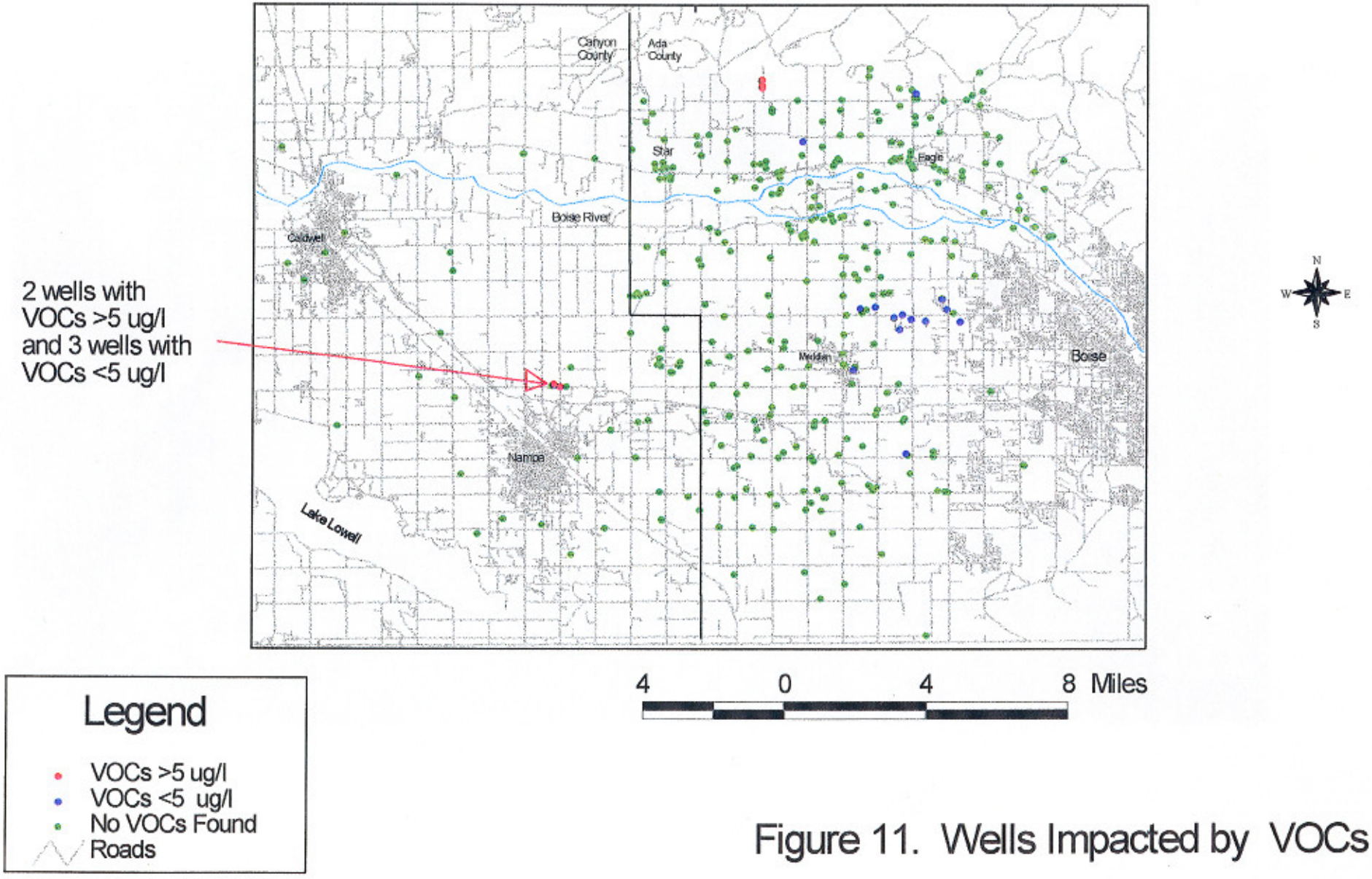


Figure 11. Wells Impacted by VOCs

throughout the study area, similar to the Boise area study results conducted in 1993-1994. 1,2,3-trichloropropane was found in three wells a short distance from each other in the Eagle/Star area. Other VOCs found were trichloroethane, 1,2-dichloropropane, 1,1,1-trichloroethane, chloroform, bromoform, dibromochloromethane, bromodichloromethane, 1,1,2,2-tetrachloroethane, sec-butylbenzene, isopropyl benzene, and 1,2,4-trimethyl benzene.

Twenty-two wells showed impacts from VOCs. Nineteen of the wells were shallow, the remaining three wells were intermediate. The following table displays the number of wells with the range of VOC results by the depth of the well:

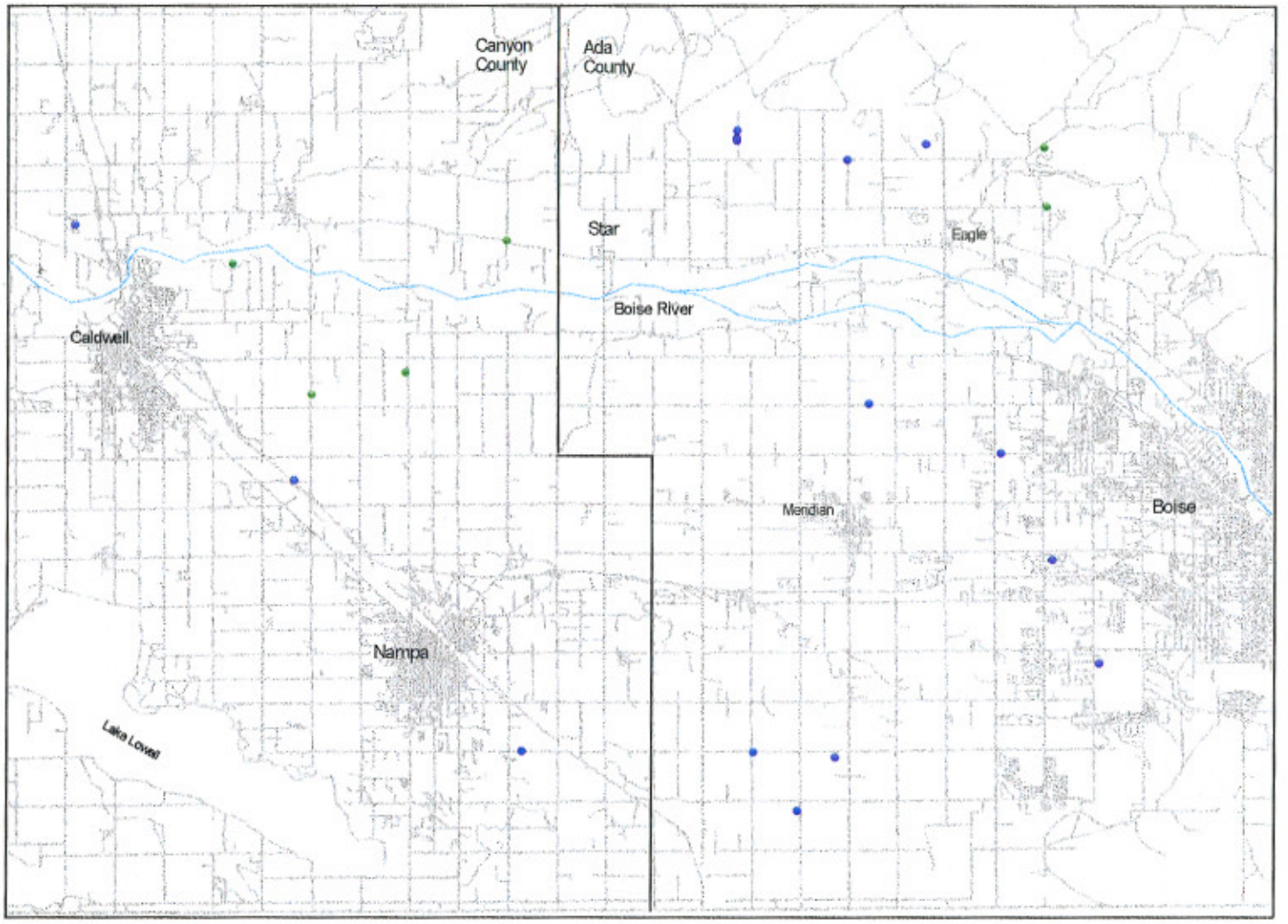
Table 4. VOC Ranges by Well Depth

A total of 335 VOC samples collected

Well Depth	Ranges of VOC Levels			
	<2 ug/l	>2-<5 ug/l	>5-<10 ug/l	>10 ug/l
<150′	217	1	1	4
150′-250′	82	0	0	0
>250′	30	0	0	0

Pesticides

The listed pesticide samples were collected by USGS for the Statewide Ground Water Monitoring Program in this study area have been included in this report. There were total of twenty-one pesticide samples collected in this project area. Pesticide levels were found in fifteen of the twenty-one samples. High levels of dacthal (38 and 110 ug/l) were found in two wells in close proximity to each other, in the Eagle/Star area. The other thirteen wells had low levels of mainly atrazine and simazine, these thirteen wells are distributed throughout the study area. See the figure on page 28 for the location of wells with positive pesticide results. Table 5 shows the number of positive pesticide



Legend

- No Pesticides Detected
- Pesticides Detected
- Roads

Figure 12. Wells Sampled for Pesticides

results by depth:

Table 5. Number of Positive Pesticide Results by Well Depth			
A total of 21 pesticide samples collected			
Well Depth	Wells Impacted by Pesticides	Domestic Use	Irrigation Use
<150′	11	12	2
150′-250′	4	5	2
>250′	0	0	0

Bacteria

A total of 26 wells, from 310 sampled, had total coliform colonies growing on the agar plates. Two of the 26 wells with total coliform also had fecal coliform in the sampled well water (both of these wells were used for irrigation purposes). The figure on page 30 shows the location of the wells impacted by bacteria. The following table lists the wells with bacteria by depth and use:

Table 6. Bacteria Results by Well Depth and Water Use				
Well Depth	Total Coliform	Fecal Coliform	Irrigation Use	Domestic Use
	Total of 310 Samples Collected	Total of 331 Samples Collected		
<150′	Positive Results		13	9
	22	2		
150′-250′	2	0	0	2
>250′	1 (stock use)	0	0	0

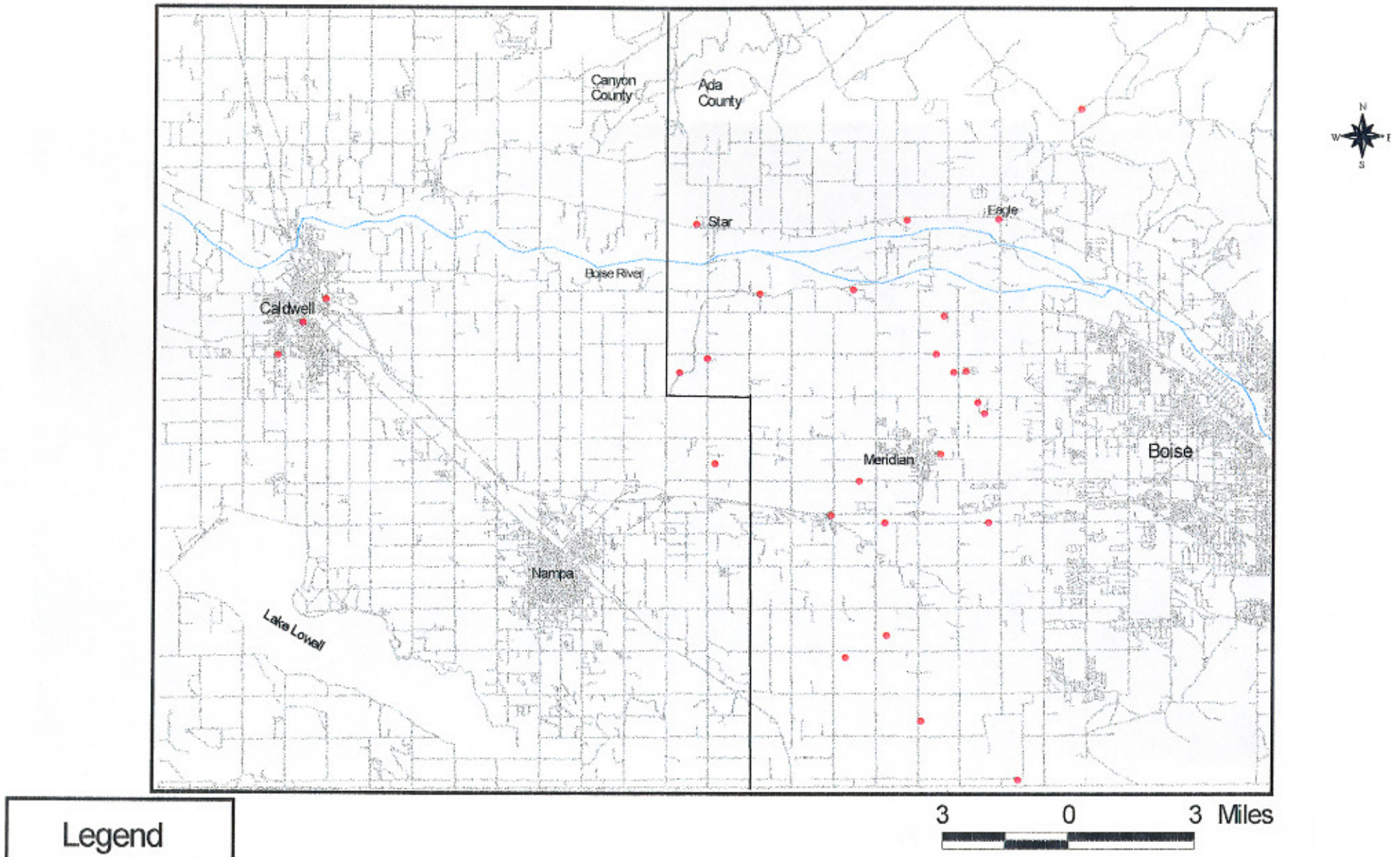


Figure 13. Wells Impacted by Bacteria

DISCUSSION

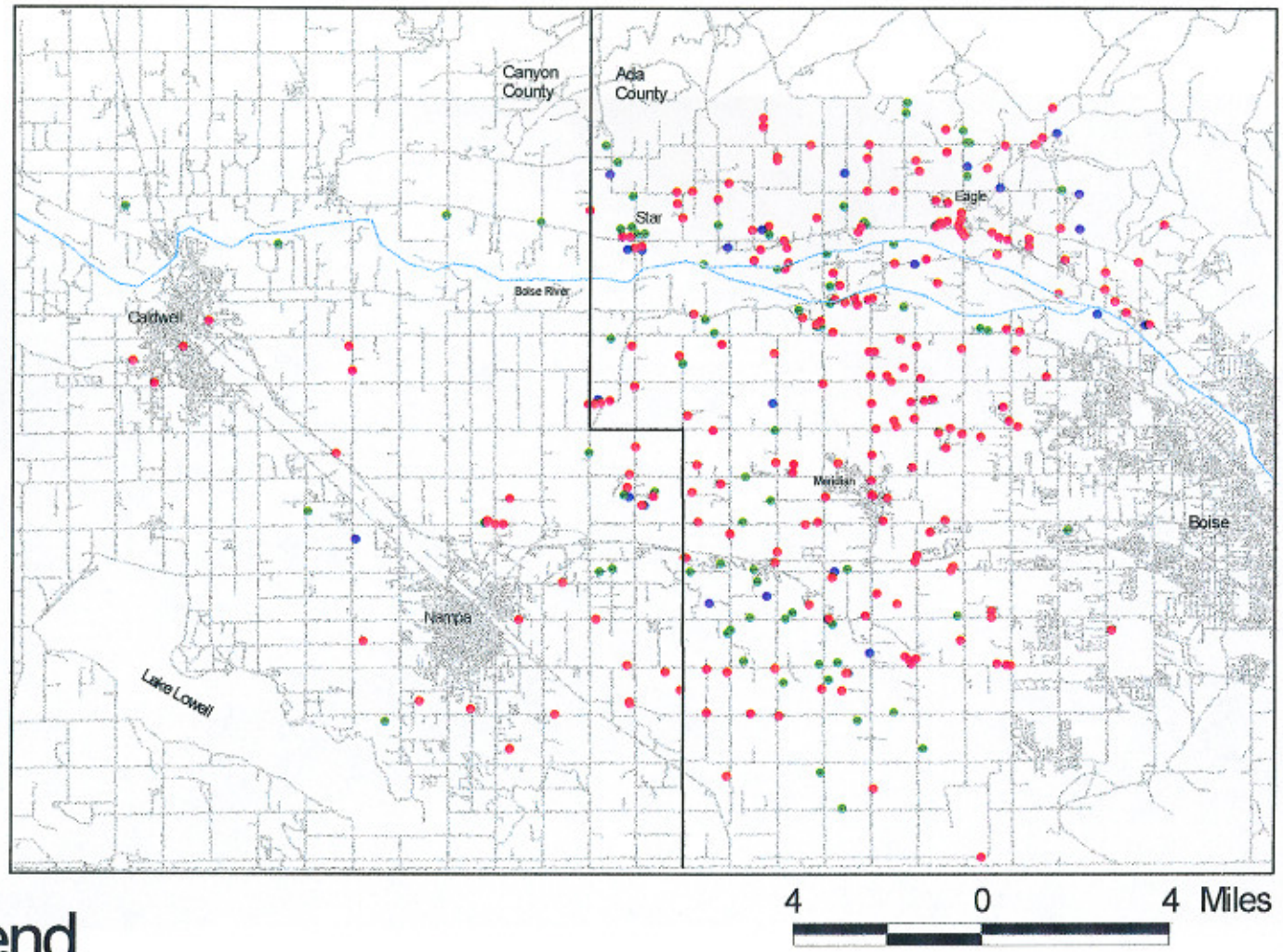
Similar to the Boise area study (Boyle 1995), the emphasis of this study was on the ground water quality in the shallow wells. From the total number of wells sampled, 67% were shallow. Wells in the intermediate and regional depths were also represented in this study to understand the ground water quality at all depths. Of the 335 wells sampled 24% were at the intermediate depth and 9% were at the regional depth. The distribution of all wells by their depths can be found in figure 14 on page 32.

The results show that the shallow wells have the most impacted ground water quality. Nitrate concentrations greater than the MCL of 10 mg/l were found in ten wells, all less than 150 feet deep. As stated in the results section, high levels of nitrate are indicators that VOCs, pesticides, and/or bacteria could also be found. 50% of all the wells sampled had nitrate concentrations at 2 to 10 mg/l and were wells at shallow or intermediate depths. In the deep wells, 30% had nitrate concentrations from 2 to less than 5 mg/l. This may be an indication of future problems with the nitrate concentrations in the deep wells greater than ambient concentrations established by the Statewide Monitoring Program for nitrate less than 2 mg/l.

The VOC results show that tetrachloroethylene with concentrations greater than the MCL 5 ug/l were found in two wells north of Nampa; both were shallow wells. Wells in close proximity to these wells were impacted by low levels of tetrachloroethylene, these were also shallow wells. A site specific study is currently being conducted in this area by DEQ to find the party responsible for the contamination.

There were twenty additional wells with low concentrations of VOCs. These twenty wells were grouped in two areas, north of Eagle/Star and northeast of Meridian; almost all are shallow wells. The area northeast of Meridian, on the Whitney Terrace (Othberg 1994), also had a number of positive bacteria results. The Whitney Terrace is composed of sandy pebble and cobble gravel. This residential area has a large number of new homes being built around the few existing farm homes. The common practice in this area was to drill shallow wells. This may be an area where the benefits of deeper wells needs to be addressed.

Two wells in the area north of Eagle and Star had elevated concentrations of a pesticide “Dacthal”, along with elevated concentrations of nitrate and VOCs (1,2-dichloropropane and 1,2,3-trichloroethylene). This area is a mix of farms and stock yards, with a change toward ranchettes (i.e. homes with 5-10 acres) steadily changing the land use. The stock yards are located to the south and cross-gradient of the ground water flow to these wells.



Legend

- Wells <150'
- Wells 150'-250'
- Wells >250'
- Roads

N
W E
S

Figure 14. Well Depths of Sites Sampled

The soils area thick blue clay with an alluvial fan on top that is medium to coarse sand interbedded with silty fine sand and silt (Othberg 1994) that is approximately 100 feet deep. The majority of the wells are drilled into the alluvial fan soils. This is also an area where the benefits of deeper wells needs to be addressed.

The intermediate and regional wells did not show impacts greater than the MCL for nitrate or VOCs, but this changes when looking at the results for bacteria. A greater percentage of shallow wells (10%) were impacted by bacteria than the deeper wells (2% in intermediate and 3% in regional), but there were wells of all depths with positive bacteria results. These wells were of different ages, drilled by different well drillers with no obvious reason to suspect problems at the site.

When looking at the results for pesticides there is a cause for concern, pesticide detections were found throughout the study area. The results show a high percentage of shallow wells, 52%, that have low concentrations of pesticides. 19% of the wells at the intermediate depth are also impacted by low concentrations of pesticides. The wells greater than 250 feet, sampled for this study, did not have any detections of pesticides. The most common pesticides found were atrazine and simazine. The 21 samples collected provided a limited, but alarming, picture of pesticide concentrations frequently found.

The benefits of deeper wells in order to obtain better quality of water may be an existing solution at this time. There are no guarantees that this will always be the solution in the future. The geology of the valley does not show, conclusively, that the impermeable clay levels uniformly separate the perceived shallow and deep aquifer. The impacts to the water quality in the shallow wells may be an indication of future impacts in deeper wells.

QUALITY ASSURANCE / QUALITY CONTROL

All probes used for measuring field parameters were inspected every morning before leaving the office. Any necessary repairs or cleaning was conducted at the DEQ-SWIRO laboratory or regional USGS laboratory in Boise, Idaho before going to the sampling sites. The condition and number of all necessary sample containers was checked before leaving for the sampling sites.

In the office each morning the Orion dissolved oxygen meter was calibrated for the day of sampling. Once calibrated, the meter would remain on for the entire day of sampling to retain the same calibration for the day. The YSI dissolved oxygen meter was calibrated at each site.

At every site, the Orion pH meter was calibrated with a daily filled small plastic container of fresh pH standard of 4 SU and 7 SU, prior to use at each site. If the ground water had a pH of greater than 7.8 SU the pH meter was re-calibrated to a pH standard of 7 SU and 10 SU.

Temperature was checked with three different instruments at each site with a non-mercury thermometer, the pH meter and the conductivity meter. The recorded ground water temperature for the field sheets were taken from the conductivity meter. The recorded air temperature on the field sheets was taken from the non-mercury thermometer.

The Orion conductivity meter was calibrated at each site with a conductivity standard as close as possible to the measurement at each site. A small plastic container of the fresh standard was placed in the bucket with the meter probes and allowed to equilibrate to the temperature of the ground water being sampled. After the samples were collected, the conductivity probe was placed into the conductivity standard to determine the correction factor.

The bucket, all hoses and splitters were kept (physically) clean. The hoses were drained at each site. The bucket, splitter and short hose were rinsed with deionized water at every site prior to packing back into the vehicle (Nielson 1991).

The in-line filter was triple rinsed with (liberal amounts of) deionized water after use at each site and then packaged into a clean zip lock bag. Latex glover were worn, at all times, when handling the in-line filter.

Latex gloves were worn when collecting all samples. They were also worn at the regional USGS Laboratory in Boise, Idaho when running the samples through the HACH kits and the portable gas chromatograph. Every sample was ran through the HACH kits for

nitrate the same day the sample was collected. Every non-preserved VOC sample was ran through the portable gas chromatograph within seven days.

All sample containers were labeled with the site identification number, date, time of sample collection, project number, and type of analysis. This information was also recorded on the field sheets, along with the field parameters and notable site conditions. All necessary laboratory forms were filled out for all samples collected. Samples were packed in ice and promptly shipped to the USGS Laboratory in Arvada, Colorado (nutrient samples) or Alpha Analytical in Sparks, Nevada (VOC samples) within the necessary time frames.

This entire project followed the guidelines for the collection, treatment, and analysis of ground water samples as used by the U.S. Geological Survey in the Statewide Monitoring Program. Copies of the Standard Operating Procedures for the collection, handling and analyses of samples for this project can be found in Appendix F.

Pesticide and metals results, included in this report, were collected by USGS for the Statewide Monitoring Program. Sample collection and HACH kit analyses were conducted by Deb Parliman, USGS; Sabrina Nicholls, USGS; and Linda Boyle, DEQ-SWIRO. Agar plate preparation and bacteria plating was conducted by Deb Parliman and Sabrina Nicholls. VOC analyses with the portable gas chromatograph was conducted by Deb Parliman.

ACKNOWLEDGEMENT

I want to express a sincere thank you to all the well owners who granted permission enter their property and sample their well water. Thanks, also, for the assistance from the Department of Water Resources with the collection of well driller's logs; Ada County Planning Association for current subdivision maps; personnel at the Ada County Landfill for well locations at the landfill; State of Idaho Bureau of Laboratories with the analysis of some bacteria samples; and to the U.S. Department of Agriculture for historic sampling information. To my colleagues Deb Parliman, USGS; Sabrina Nicholls, USGS; Ron Lane, DEQ-SWIRO; Mike Ingham, DEQ-SWIRO; A.J. Cude, DEQ-SWIRO; Rob Howarth, DEQ-SWIRO; Joe Baldwin, DEQ; Dean Yashan, DEQ; and Tom Schmalz, CDHD for their helpful comments regarding this report.

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